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COMPARATIVE STUDY OF TYPE I AIRPLANES WITH VARIOUS POWER PLANTS

(AIRPLANE SECTION REPORT)

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COMPARATIVE STUDY OF TYPE I AIRPLANES WITH VARIOUS POWER PLANTS.

The purpose of this report is to determine the relative advantages of three types of engines for single-seater pursuit airplanes from the standpoint of weight and size. The engines chosen were the high-compression Wright "H," the high-compression Liberty "12," and the large Packard "12." As the weight of the complete power plant and the disposable load forms such a large proportion of the total weight of an airplane of this type, it is possible to get an accurate comparison between the gross weights of airplanes equipped with different engines. If the type of construction is the same in each case, and if the same materials are used, the structure will in each instance form the same percentage of the total weight, provided the factors of safety are the same for each design.

The fuel and oil required to give the required duration of one-half hour at the ground and two and a half hours at 15,000 feet were computed from a standard table prepared by the power-plant laboratory. The fuel tank and radiator weights were calculated in detail and on the same basis for the three designs.

In computing the dimensions of the wing cellules with the different designs the wings were assumed to be geometrically similar except that the fuselage width was taken constant at 30 inches. Two per cent in each case was allowed for wing cut-outs.

The conclusion to be drawn from Table 2 is that the use of the Packard 2025 in a pursuit airplane would not only result in a much larger, heavier, and less maneuverable airplane but would actually give a higher power loading than the designs with the smaller engines. Until lighter high-power engines are developed the high-compression Liberty "12" is the largest engine that can compete with engines similar to the Wright "H" or Wright radial. Until the excessive vibration of the high compression Wright is overcome it will not be entirely satisfactory. Up to the present time this engine has apparently a smaller power drop off than the high-compression Liberty "12," but the effect of the improved altitude control on the Liberty "12," which has not been tried out as yet, may cause it to be fully as efficient at high altitudes as the Wright engine. If this can be accomplished, the high-compression Liberty would be without doubt the best engine for pursuit airplanes.

TABLE 1.

	Wright HC "H."	Liberty HC-"12."	Packard 2025.
Engine	627	856.6	1,142
Engine water	58	45	58
Propeller	38	44	55
Engine manifolds	15	22	28
Main fuel tank	79	86	103
Gravity fuel tank	48	48	56
Gas piping	18	22	25
Oil tank	16	18.5	24
Oil piping	4	5	6
Water and piping	12	15	20
Expansion tank and water	18	19	20
Radiator and water	115	184	255
Engine controls	8	8	10
Radiator shutters	15	20	25
Total	1,071	1,393	1,832

TABLE 2.—*Comparative weights and dimensions of Type I airplanes.*

	Wright HC "H."	Liberty HC-"12."	Packard 2025.
Power plant	1,071	1,393	1,832
Fuel	384	420	568
Oil	54	63	87
Crew	180	180	180
Armament	215	215	215
Equipment	130	130	130
Gross weight minus structure	2,034	2,401	3,012
Structure, assumed to be 25 per cent of gross weight	676	799	1,008
Gross weight (pounds)	2,710	3,200	4,020
Wing area at 9 pounds per square foot	301	356	447
Span as biplane with aspect ratio of 5.5 (feet)	29.7	32.2	36.0
Chord (inches)	64.7	70.2	78.5
Normal power in flight	360-2,000	450-1,700	540-1,800
Pounds per horsepower based on normal power in flight	7.52	7.11	7.45
Power from laboratory test curves	377-2,000	472-1,700	560-1,800

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